As aluminium alloy become more popular in the building industry (Miller et al. 2000; Roy et al. 2021; International Aluminium Institute 2011), the uses of such ~~back-to-back~~consecutive built-up sections as the primarly load bearing column members are increasing. This ~~paper~~ study ~~considers~~ presents the axial strength of ~~such~~ these sections and 12 new ~~experimental~~ empirical tests and 246 finite element (FE) analysis results ~~on presented~~. Fig.1 ~~shows~~ presents the ~~details of the~~ built-up columns ~~investigated~~ studied in this ~~study~~work. An image ~~photograph~~ of the built-up section prior to compression test is shown in Fig.2, where the general arrangement of the intermediate screw fasteners between the back-to-back channels are shown.

The Aluminium Design Manual (ADM 2020) and Eurocode 9 (CEN 2007) both provide recommendations for designing the aluminium alloy single channel ~~section~~ columns under axial load. ~~However~~On the other hand, they do not ~~include~~ comprise recommendations for such ~~back-to-back~~ consecutive built-up aluminium alloy channel sections. The American Iron and Steel Institute (i.e. AISI 2016) and the Australian and New Zealand Standards (i.e. AS/NZS 2018) both recommend the ~~same~~ modified slenderness ~~approach~~ technique to ~~take into account~~ consider the spacing of the screws in the built-up columns. ~~However, t~~This approach, however, is for cold-formed steel (CFS) members ~~instead~~ rather than for ~~of~~ aluminium alloy members. In the existing body of literature, no ~~papers~~ studies have been reported addressing this issue.

For the cold-formed type of carbon steel, ~~however~~on the other hand, ~~research~~ everal studies are available. ~~has been reported.~~ Ting et al. (2018) ~~investigated~~ studied the ~~effect~~ impact of screw-spacing on the axial strength of the ~~back-to-back~~consecutive built-up CFS channel sections, as shown in ~~(~~Fig. 3~~)~~. Roy et al~~'s~~ (2018a, 2018b) ~~investigated~~ studied the ~~effect~~ impact of a gap (Fig. 4). Crisan et al. (2014) ~~presented~~ reported ~~the results of~~ numerical ~~models~~model results, whereby the sections were ~~built~~ constructed ~~up through~~ via battens. Rondal and Niazi (1990) ~~described~~ reported laboratory ~~tests~~ results for built-up or constructed CFS columns~~,~~ that are connected with spacers. A work by Dabon et al. (2015a, 2015b) ~~studied~~ investigated the ~~behaviour and~~ design of CFS battened built-up or constructed columns. ~~Recently~~In a recent work by~~,~~ Roy at el. (2018c), ~~investigated~~ the ~~effect~~ impact of section thickness was investigated. Additionally, Fratamico et al. (2018) ~~studied~~ investigated ~~the collapse of back-to-back~~consecutive built-up CFS lipped channel section colum collapse~~ns~~. ~~For~~ In terms of un-lipped channels, Roy et al. (2019) ~~investigated~~ studied the ~~effect~~ impact of screw spacing, ~~conclusing~~ with a conclusion that ~~AISI 2016 &~~ AS/NZS 2018 and AISI 2016 can be rather un-conservative ~~for~~ in terms of built-up columns, whereby failure is ~~through~~ via local buckling. ~~Finally,~~ Kesawan et al. (2017) ~~presented~~ investigated ~~an experimental investigation on~~ the structural performance by utilizing ~~using~~ hollow flange I-section columns.

~~At the same time, s~~Stainless steel built-up columns ~~are~~ are ~~also~~ increasingly becoming ~~increasingly~~ popular~~;~~. ~~they~~ They are generally aesthetic, ~~posess~~ have good corrosion resistance and are ~~therefore~~ thus eas~~y to~~ily-maintained~~,~~. ~~and~~ The area is also convenient ~~for~~ in terms of construction~~assemblage and constructing.~~ (Young and Hartono 2002). ~~Standdards~~ The standards that ~~cover~~ are associated with stainless steel built-up columns ~~include~~ comprise AISI 2016, AS/NZS 2001, ~~AISI 2016 and~~ as well as ASCE 2002~~;~~. ~~it~~ It ~~should~~ is worthy to note that ~~be noted though that~~ the design ~~guidanmce~~ is not ~~specific to the~~ associated with grade. ~~In terms of recent studies,~~ Yuan et al. (2014) ~~presented~~ demonstrated ~~the results of~~ experimental ~~tests~~ results on ~~stainless~~ steel ~~back-to-back~~consecutive built-up sections ~~under~~ with axial compression. Roy et al. (2018d, 2019b, 2019c, 2019d) and Dobric et al. (2018a, 2018b) have ~~considered~~ investigated the behaviour of ~~different~~ various cross-sections ~~under~~ with axial compression. ~~Finally,~~ Kechidi et al. (2017~~;~~, 2020) ~~investigated~~ studied the screw~~s~~ spacing~~s~~ ~~and~~ as well as their ~~effect~~ impact on axial strength.

As previously mentioned ~~previous~~, however, ~~for~~ in terms of the ~~aluminium alloy~~ single channel ~~section~~ section-type columns, ~~research reported in~~ the literature is ~~limited~~lacking. Feng et al. (2015,2016,2017) and Chen et al. (2017,2018) investigated the effect of perforations on such single channel section used as columns; these included columns, square-shaped hollow section members, circular-shaped ~~hollow~~ section tubes, ~~and~~ as well as square and rectangular shaped sections. From this work it was found that ~~current~~ recent rules for design ~~rules~~ (CEN 2007) were ~~not~~ inappropriate for ~~determining~~ checking their strength under compression. ~~Furthermore,~~ Huynh et al. (2016a, 2016b, 2020) ~~conducted~~

carried out ~~experiments to~~ a series of studies on ~~study~~ the buckling behaviour of the ~~aluminium alloy~~ channel sections. ~~For~~ In the case of ~~aluminium alloy~~ angle sections, Mazzolani et al. (2000, 2011) ~~investigated~~ studied the ~~effects~~ impact of the width ~~to~~ and thickness ratio, ~~and~~ as well as the ~~occurrence of~~ local buckling for ~~such~~ these sections under various axial compression levels. Su et al. (2013, 2014, 2016) ~~has developed~~ proposed a Continuous Strength Method ~~(CSM)~~ to ~~study~~ investigate the overall compression resistance of the ~~aluminium alloy~~ column members.

In this ~~paper~~work, the results ~~of~~ from 12 ~~new~~ novel ~~experimental tests~~ empirical ~~are~~ are ~~reported~~ presented for ~~back-to-back~~consecutive ~~built-up aluminium alloy~~ channel sections under various compression levels. Geometric imperfections were measured ~~Using~~ using a laser scanner~~, the geometric imperfections were measured~~. The material ~~properties~~ characteristics of the ~~aluminium~~ alloy were ~~determined~~ investigated ~~through~~ via tensile coupon ~~tests~~ assessments ~~taken from~~ of the channel sections. A nonlinear elasto-plastic FE ~~model~~ structure was ~~described~~ presented and the empricial results were validated ~~against~~ against the experimental results. A parametric ~~study~~ investigation ~~comprsing~~ with 234 ~~new~~ novel results was ~~undertaken~~ carryout out to ~~investing~~ determine the ~~effect~~ impact of ~~the~~ the following parameters: hole spacing, modified slenderness, ~~hole spacing~~ and section thickness. ~~Finally, t~~The ~~experimental and~~ numerical results were ~~used~~ utilied to ~~to assess~~ test the overall performance of the ~~design~~ design, ~~namely,~~ including CEN 2007, ADM 2020, ~~CEN 2007 and~~ AISI 2016 ~~&~~, as well as AS/NZS 2018.